

Canaries in the Coal Mine? Six Facts About the Recent Employment Impacts of Artificial Intelligence

Erik Brynjolfsson, Bharat Chandar, and Ruyu Chen

Stanford University

October 7, 2025

Lots of discussion about AI's impact on the entry-level labor market

 **FORTUNE**

SEARCH [SUBSCRIBE NOW](#) SIGN IN

SUCCESS CAREERS

Software engineer lost his \$150K-a-year job to AI—he's been rejected from 800 jobs and forced to DoorDash and live in a trailer to make ends meet



A software engineer is “living like basically everyone in this time,” says Sean R., an engineer who was forced to leave his \$150k-a-year job at a tech company and now works for DoorDash while living in a trailer.

 **Facebook**
May 16, 2023 | 1 min read

 **The New York Times**

Opinion | A ‘White-Collar Blood Bath’ Doesn’t Have to Be Our Future

Instead of asking which future is coming, we should be asking which future we want.
2 days ago



 **Business Insider**

The AI coding apocalypse

In the age of artificial intelligence, entry-level coders are doomed. But some engineers are thriving.

Feb 25, 2025



 **Axios**

Behind the Curtain: Top AI CEO foresees white-collar bloodbath

Dario Amodei — CEO of Anthropic, one of the world’s most powerful creators of artificial intelligence — has a blunt, scary warning for the...

1 month ago



 **The New York Times**

Opinion | I’m a LinkedIn Executive. I See the Bottom Rung of the Career Ladder Breaking.

Eventually, A.I. will create plenty of jobs. The World Economic Forum predicts that number could be as high as 78 million more jobs, even after...

1 month ago



“Canaries in the coal mine” for AI’s impact

Are we already seeing changes in the labor market driven by AI? Particularly for entry-level workers?

- ▶ **ADP:** monthly payroll records through July 2025 for millions of workers

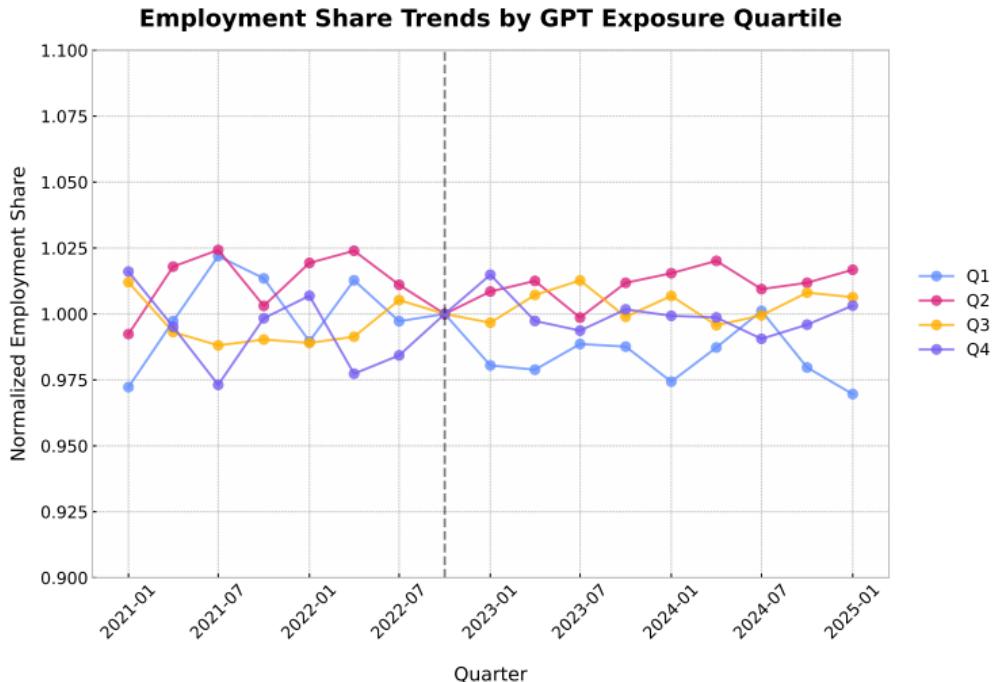
Preview of results

- ▶ ↓ in employment for 22-25 y/o AI-exposed workers
 - 13% ↓ with firm-time effects
- ▶ No employment decline for unexposed or experienced workers
- ▶ ↓ entry-level employment for *automative* but not *augmentative* work
- ▶ Limited change in annual salary
- ▶ Robust across alternative samples (w/o tech sector, non-teleworkable, etc.)

Compared to prior work, use large-scale, real-time data

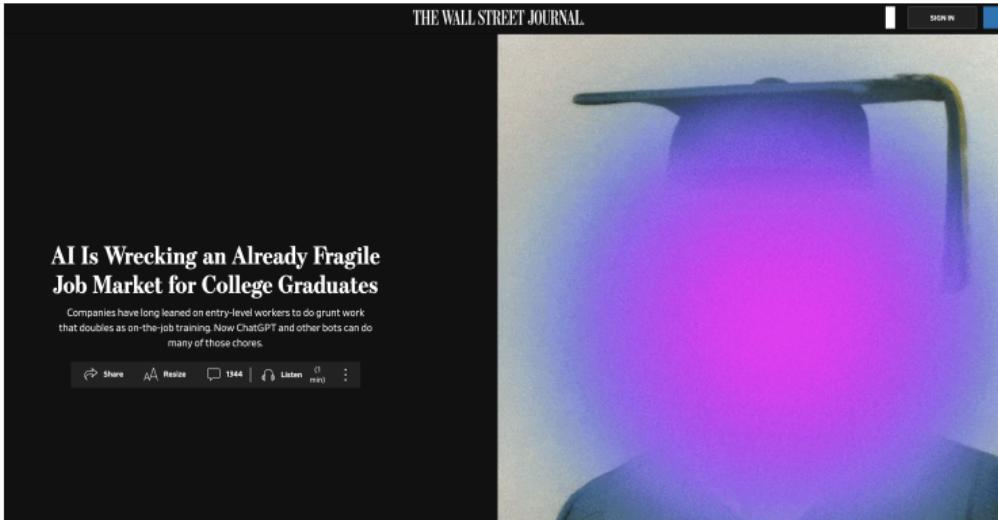
- ▶ **CPS data:** Chandar (2025); Dominski and Lee (2025); Lim et al. (2025); Eckhardt and Goldschlag (2025); Gimbel et al. (2025)
 - Not much evidence of widespread labor market disruption
 - Very small samples for individual age-occupation cells
- ▶ **Other work:** Humlum and Vestergaard (2025); Hampole et al. (2025); Johnston and Makridis (2025)
 - Possibly increased overall hiring in exposed industries
 - Cannot look at time series for age-occupation in recent periods
- ▶ **ADP data real-time, large-scale, worker-firm panel**
 - Doshay and Bantock (2025); Hosseini and Lichtinger (2025); Klein Teeselink (2025)

Not seeing widespread job displacement in government data



Chandar (2025); Eckhardt and Goldschlag (2025); Gimbel et al. (2025)

But what about young workers? Not enough data



Despite warnings in business in media

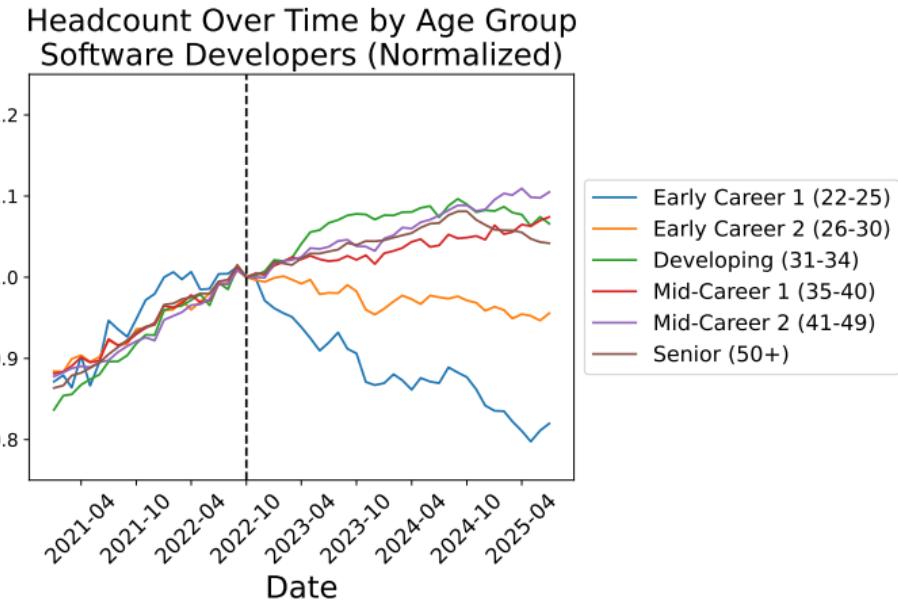


“AI could wipe out half of all entry-level white-collar jobs — and spike unemployment to 10-20% in the next one to five years”

How we study this

- ▶ ADP
 - Full-time, regular workers 22-70
 - Balanced sample of firms 2021-2025 (remove companies entering and leaving)
 - 3.5-5 million workers observed per month
- ▶ AI exposure measures
 - GPT-4 β from Eloundou et al. (2024)
 - Overall, automation, and augmentation measures from Anthropic Economic Index (Handa et al., 2025)

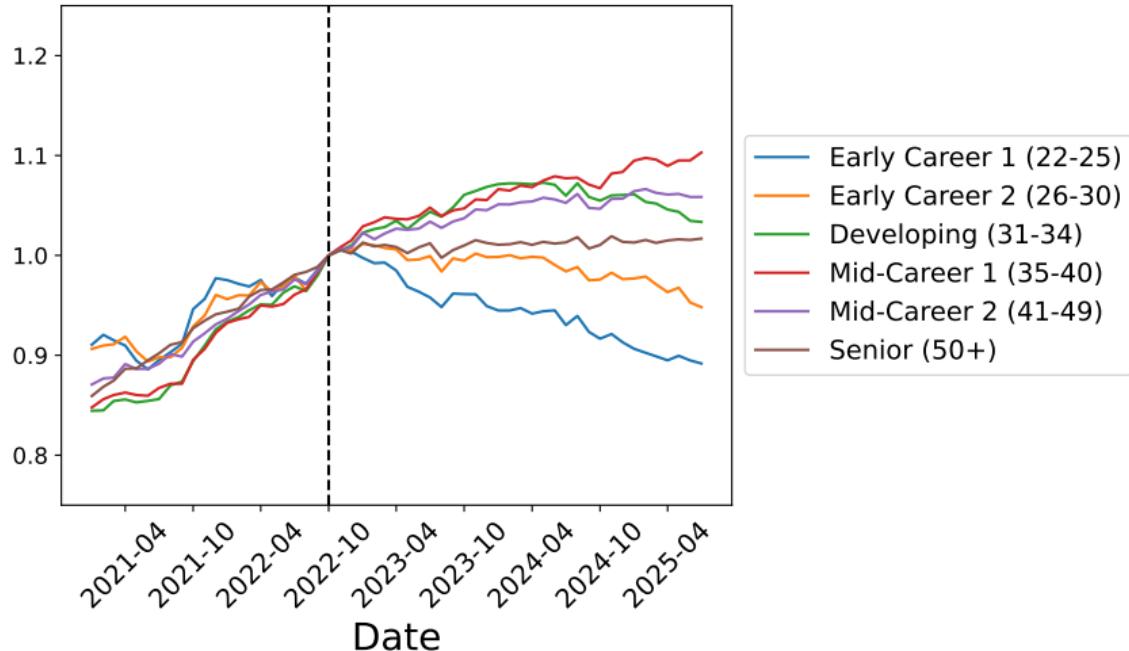
Fact 1: Employment Declines for Young, Exposed Workers



20% ↓ for 22-25 y/o software developers since late 2022

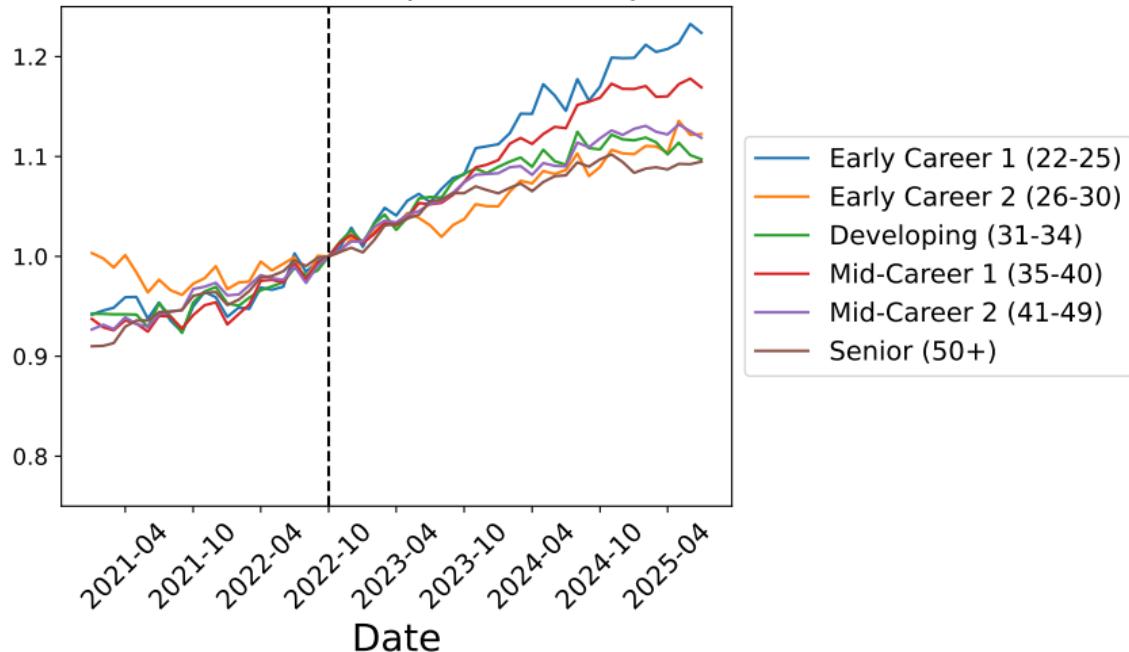
Similar findings for customer service

Headcount Over Time by Age Group
Customer Service (Normalized)



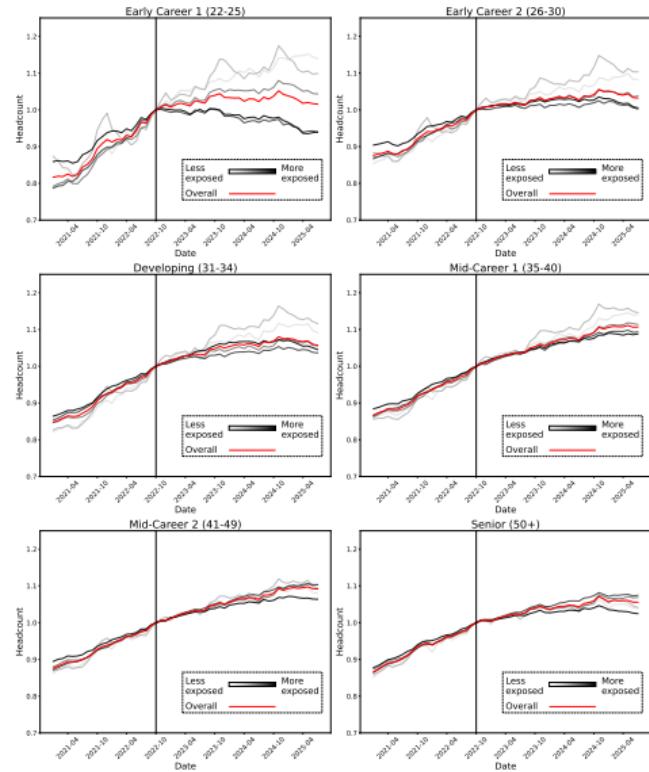
Opposite patterns for health aides

Headcount Over Time by Age Group
Health Aides (Normalized)



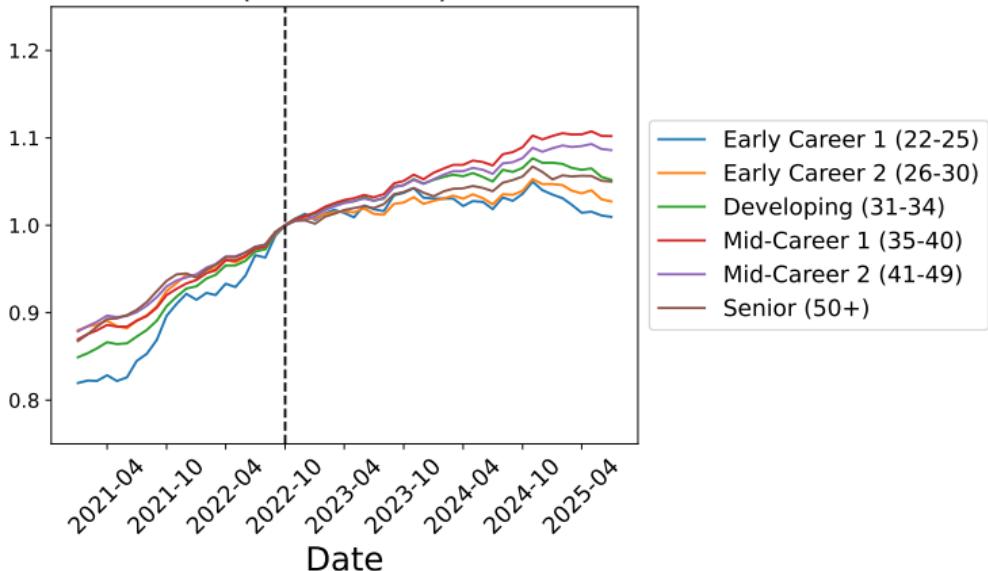
Findings hold more generally across exposure levels

- ▶ Exposure from Eloundou et al. (2024)
- ▶ Darker lines more exposed

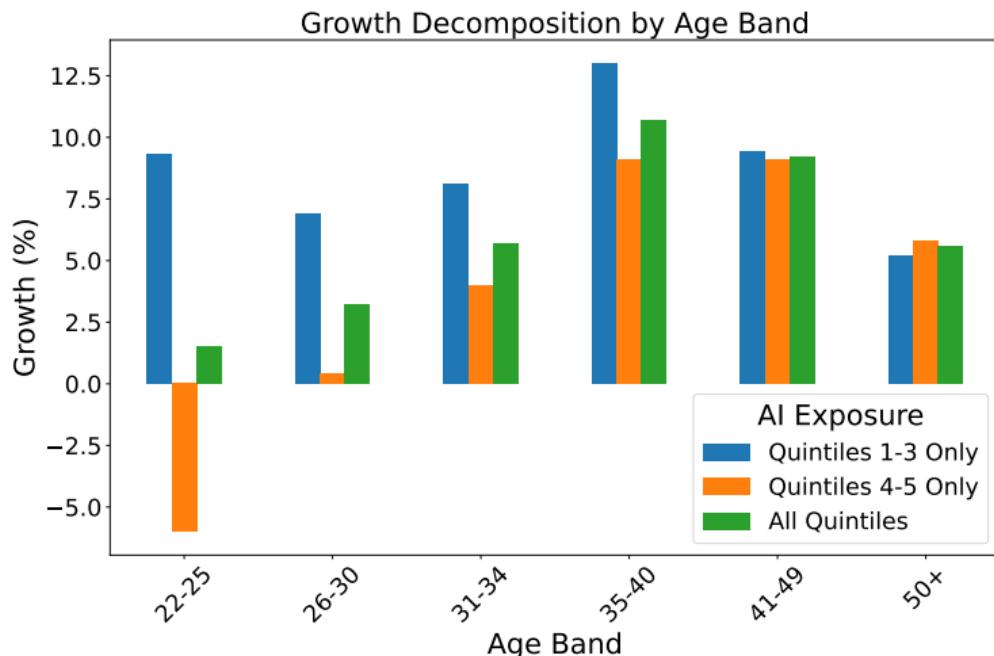


Fact 2: Overall a relative slowdown in entry-level hiring

Headcount Over Time by Age Group
(Normalized)



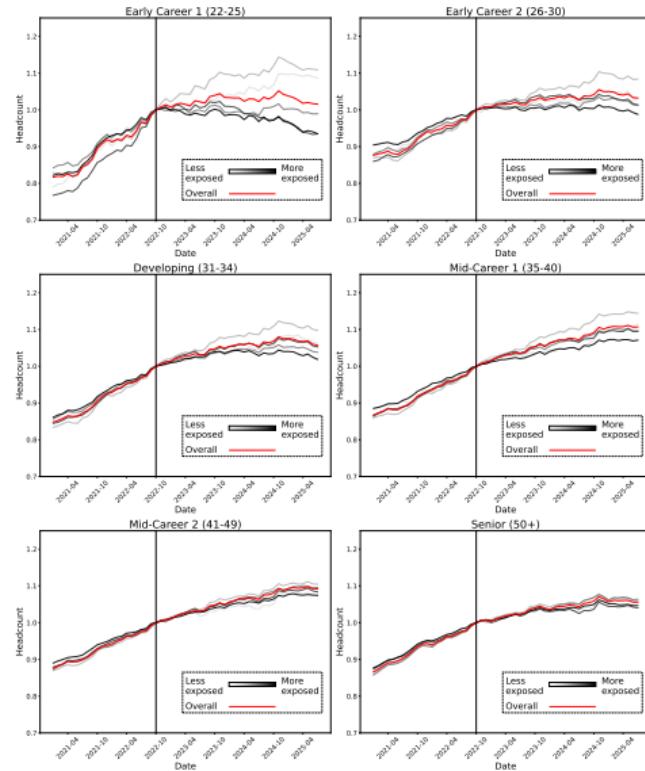
Slowdown driven by jobs exposed to AI



Could be driven by other changes in US economy. **Test alternatives.**

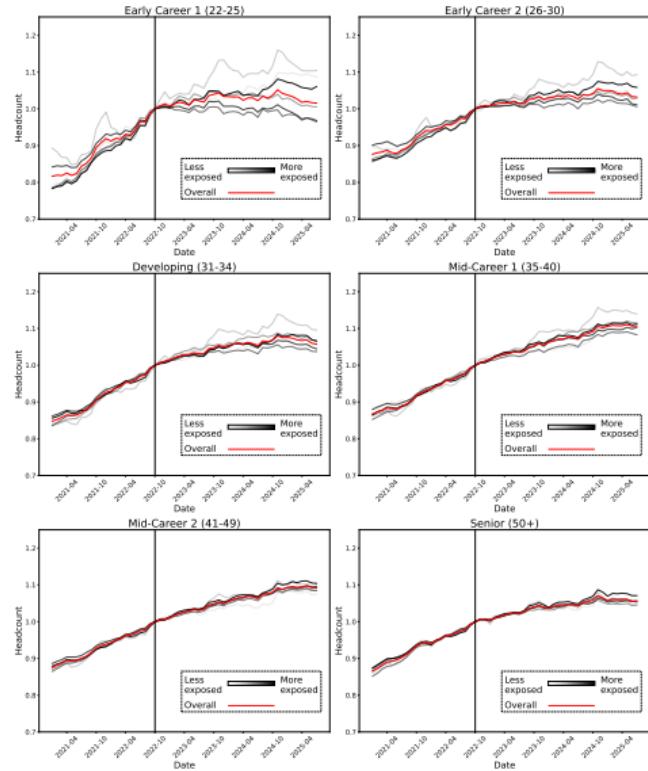
Fact 3: Employment ↓ in jobs where AI automates work

- ▶ By occupational **automation exposure** from Claude
- ▶ Ex: Software, accounting and auditing, information clerks



Fact 3: Employment ↑ in jobs where AI augments work

- ▶ By occupational **augmentation exposure**
- ▶ Ex: Management, nursing, maintenance and repair



Automation vs augmentation classification

Automotive Behaviors	Augmentative Behaviors
<p><i>AI directly executes tasks with minimal human involvement</i></p>	<p>AI enhances human capabilities through collaboration</p>
<p>Directive: Complete task delegation with minimal interaction</p> <p><i>Illustrative Example: "Format this technical documentation in Markdown"</i></p>	<p>Task Iteration: Collaborative refinement process</p> <p><i>Illustrative Example: "Let's draft a marketing strategy for our new product. ... Good start, but can we add some concrete metrics?"</i></p>
<p>Feedback Loop: Task completion guided by environmental feedback</p> <p><i>Illustrative Example: "Here's my Python script for data analysis – it's giving an IndexError. Can you help fix it? ... Now I'm getting a different error..."</i></p>	<p>Learning: Knowledge acquisition and understanding</p> <p><i>Illustrative Example: "Can you explain how neural networks work?"</i></p>
	<p>Validation: Work verification and improvement</p> <p><i>Illustrative Example: "I've written this SQL query to find duplicate customer records. Can you check if my logic is correct and suggest any improvements?"</i></p>

Fact 4: Robustness to Firm-Level Shocks

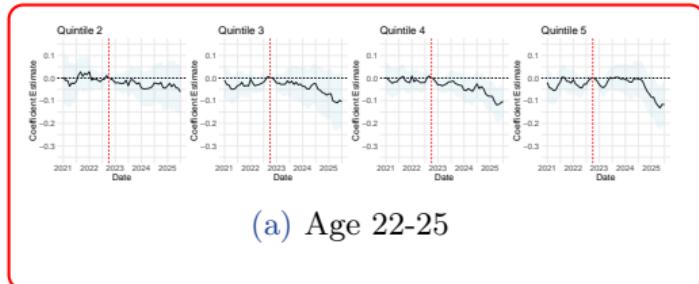
- ▶ Alternative explanation: industry- or firm-level shocks correlated with occupational sorting (e.g., interest rate changes).
- ▶ Event study Poisson regression with firm-time and firm-quintile fixed effects

$$\log(E[y_{f,q,t}]) = \sum_{q' \neq 1} \sum_{j \neq -1} \gamma_{q',j} 1\{t = j\} 1\{q' = q\} + \alpha_{f,q} + \beta_{f,t} + \epsilon_{f,q,t} \quad (1)$$

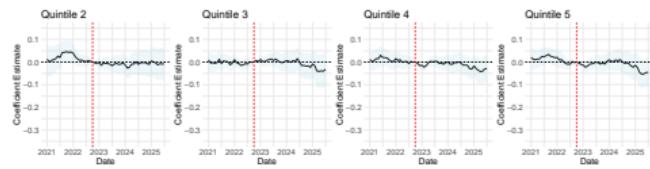
Run separately for each age group

- ▶ Absorbs shocks that affect *all workers* in a firm
 - Relative hiring changes for more- and less- exposed workers

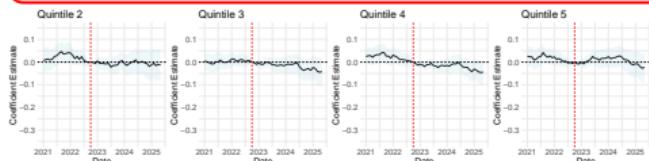
Fact 4: 13% relative ↓ in employment for exposed young workers



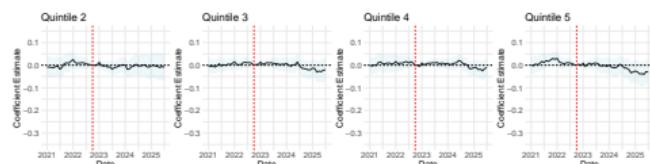
(a) Age 22-25



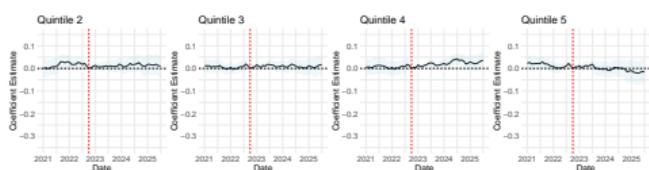
(b) Age 26-30



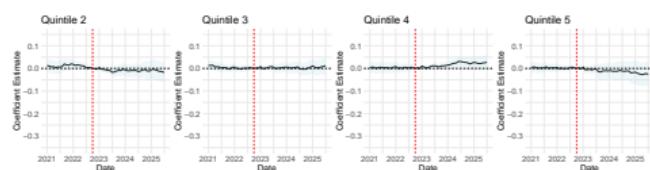
(c) Age 31-34



(d) Age 35-40

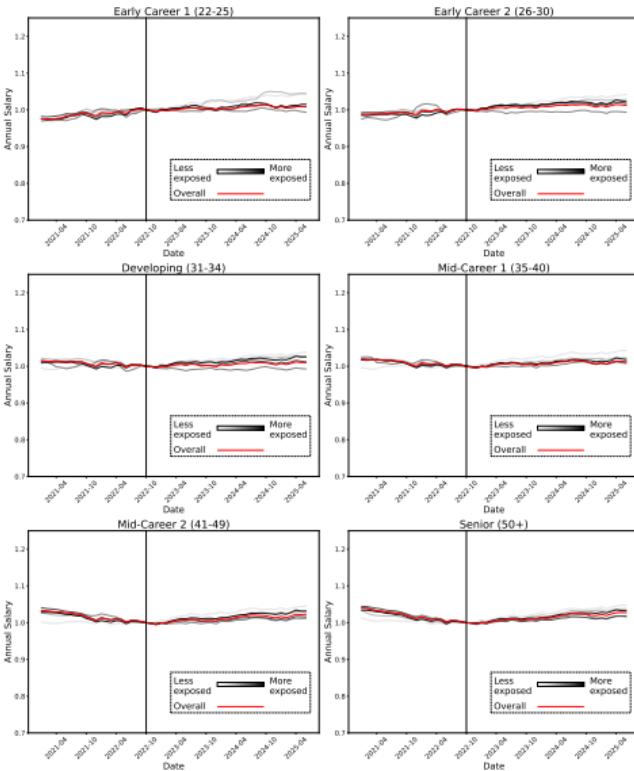


(e) Age 41-49



(f) Age 50+

Fact 5: No clear divergence in compensation



Fact 6: Trends hold under alternative analyses

1. Excluding tech sector [► 1](#) [► 2](#)
2. Teleworkable vs non-teleworkable jobs [► 1](#) [► 2](#)
3. College vs non-college workers [► 1](#) [► 2](#)
4. Men and women [► M](#) [► F](#)
5. Part-time and temporary workers [► View](#)

And more in the paper

AI and Labor Markets: What We Know and Don't Know

Some claims about AI and the Labor Market

- ▶ The overall impact of AI on aggregate employment is likely small right now
- ▶ AI is likely diminishing hiring for AI-exposed entry-level jobs

Next steps:

- ▶ Building employment trackers using high-quality data
- ▶ Firm AI adoption data, ideally an A/B test on adoption

AI exposure measures are better than most people think

- ▶ Tomlinson et al. (2025) find 70-90% correlation between Copilot usage and Eloundou et al. (2024) exposure
- ▶ Exposure predicts employment changes

Next steps:

- ▶ Actual large-scale data from AI labs on usage by occupation

Gathering new evidence on where we expect greatest AI progress

- ▶ Ongoing work from Brynjolfsson, Halperin, Ramani, Bommasani, others
- ▶ GDPval (Patwardhan et al., 2025), Apex from Mercor

Next steps:

- ▶ Prediction markets for future disruption by occupation?

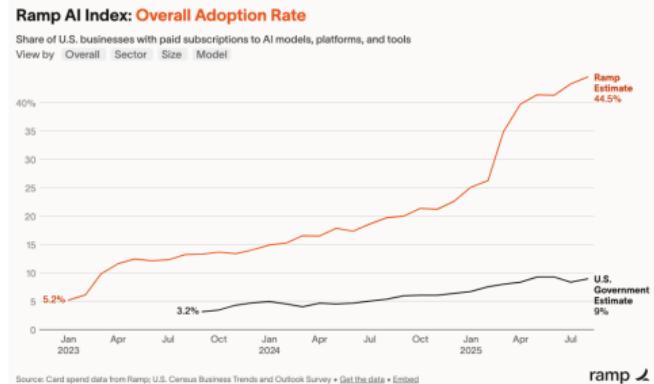


More areas for data

- ▶ Other countries?
- ▶ Firm adoption?
- ▶ Jobs with future labor demand?

Next steps:

- ▶ Better data collection and modeling



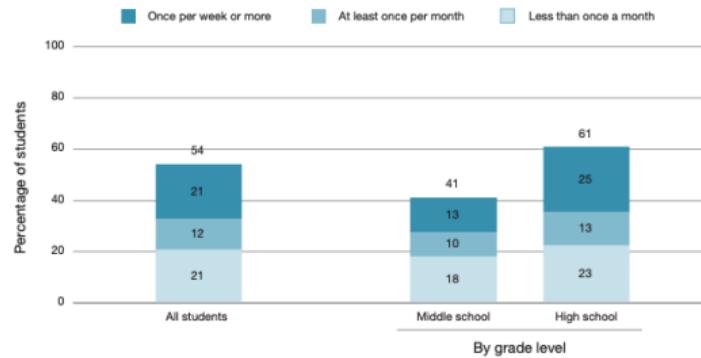
What is happening with education?

- ▶ Changing major choices? Career choices?
- ▶ Impacts on learning?
- ▶ Changes in curricula?
- ▶ Personalized learning?

Next steps:

- ▶ Need a lot more data

FIGURE 1
Student-Reported Frequency with Which They Use AI for Schoolwork

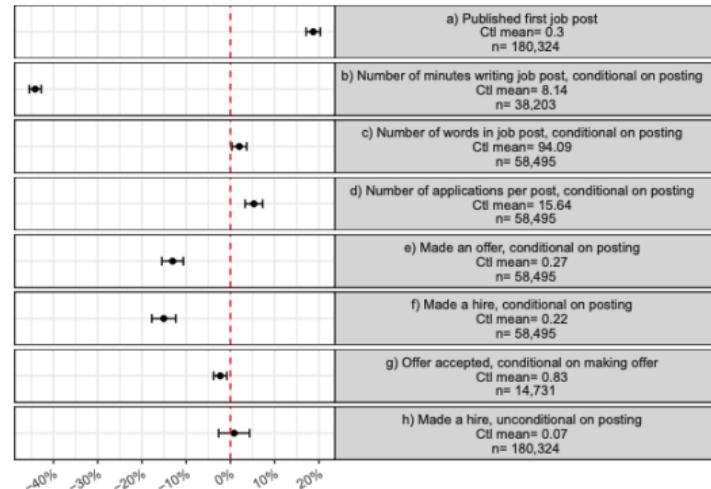


How does AI affect labor market matching?

- ▶ Reduces frictions?
- ▶ Or harms matching in equilibrium?

Next steps:

- ▶ Data on health of matching process



Wiles and Horton (2025)

Income and wealth inequality?

- ▶ Labor vs investment earnings
(Rockall et al., 2025)

Next steps:

- ▶ Data from other countries,
counterfactuals

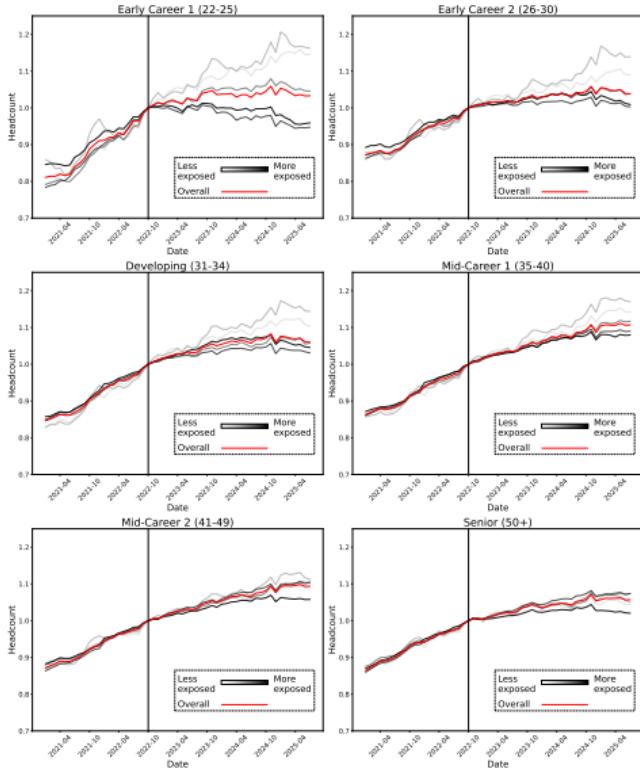


More empirically-calibrated theory and counterfactuals

- ▶ Structural models of labor market impacts
- ▶ Policy counterfactuals
- ▶ Empirically calibrated

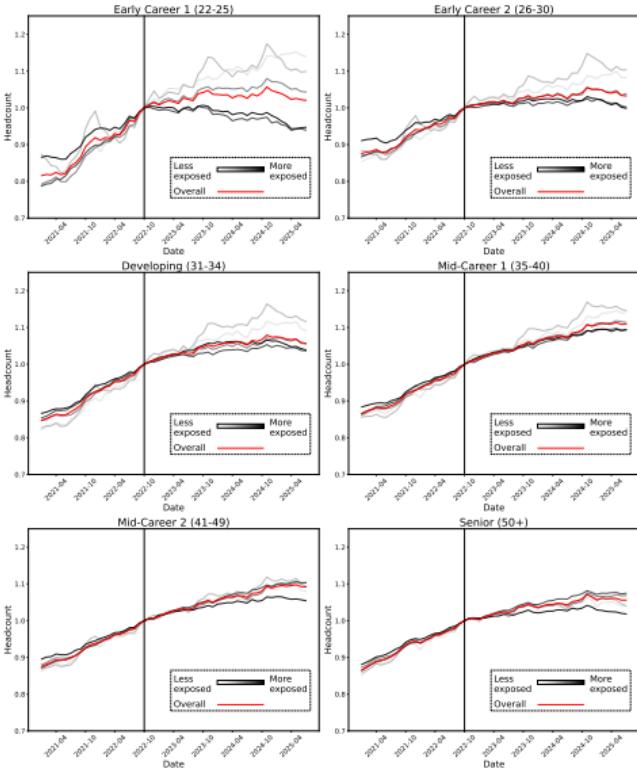
Appendix

No IT sector (NAICS 51) Back



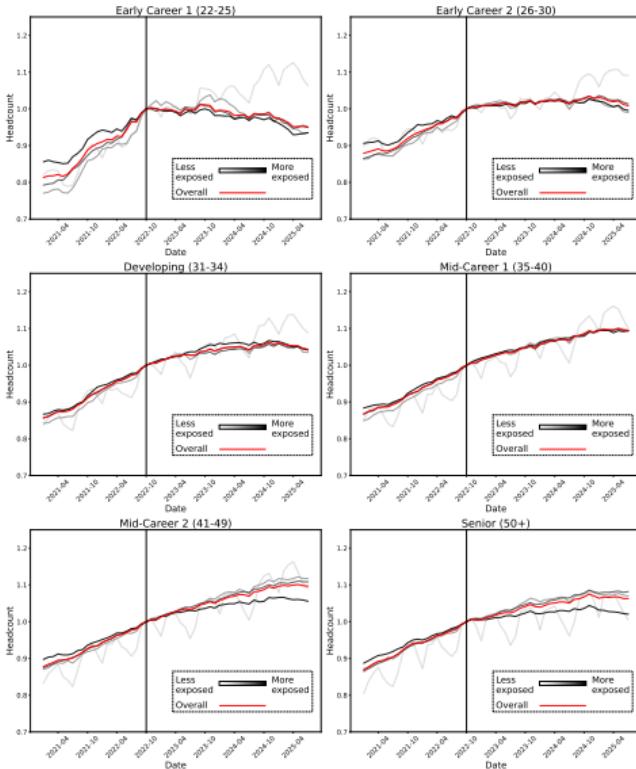
No computer occupations (SOC code 15-1)

[Back](#)



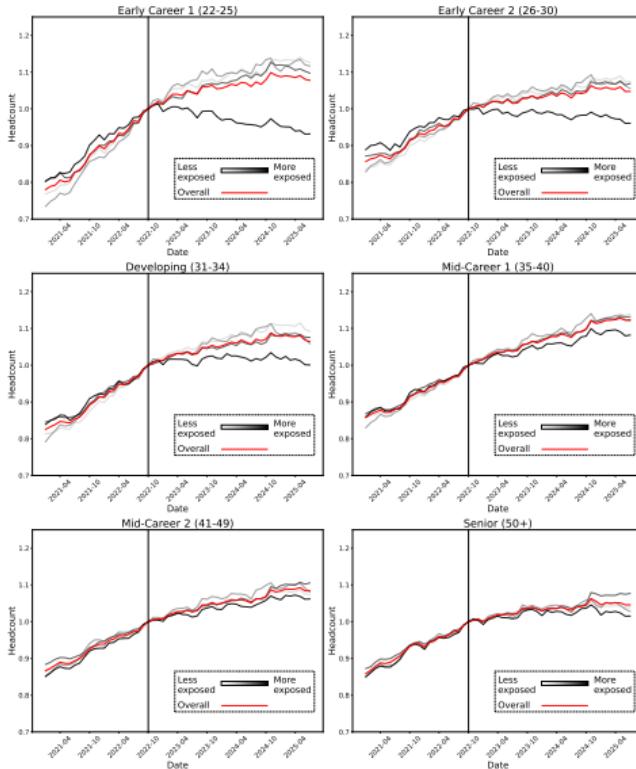
Teleworkable jobs

▶ Back



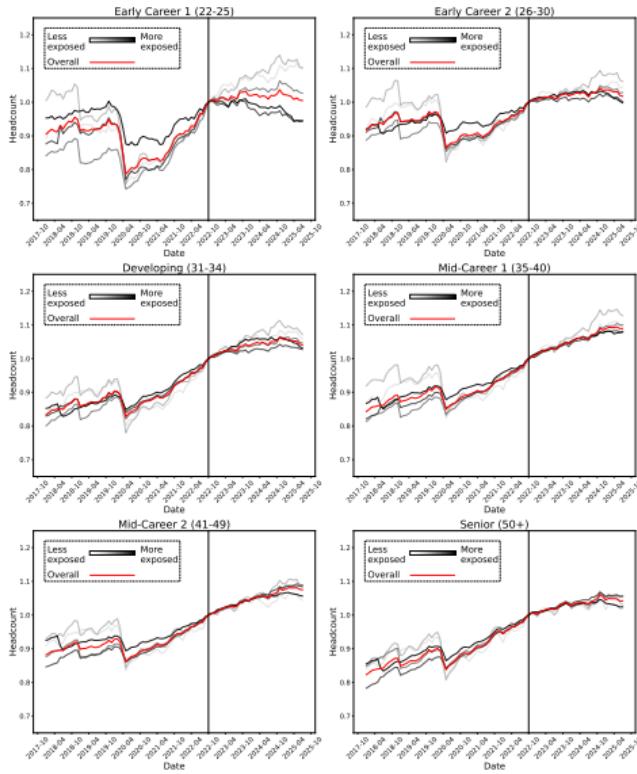
Non-teleworkable jobs

Back



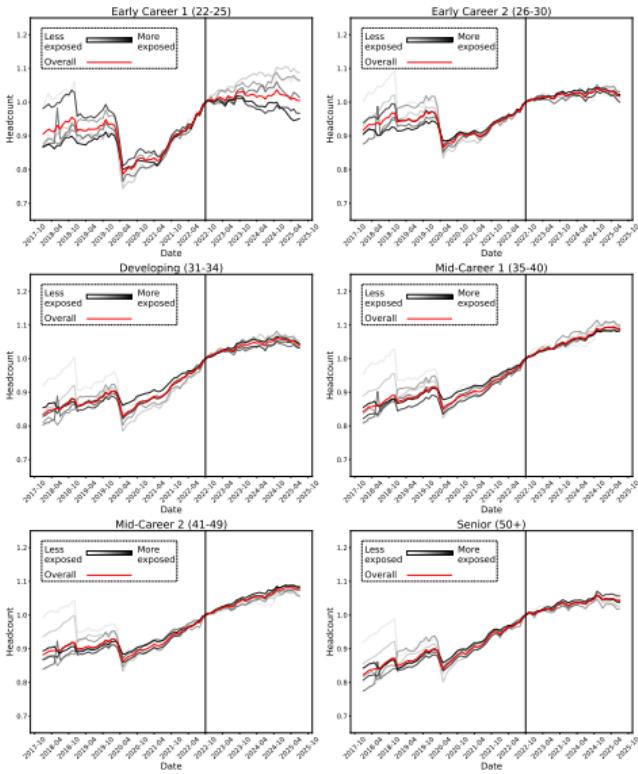
Longer horizon

[Back](#)



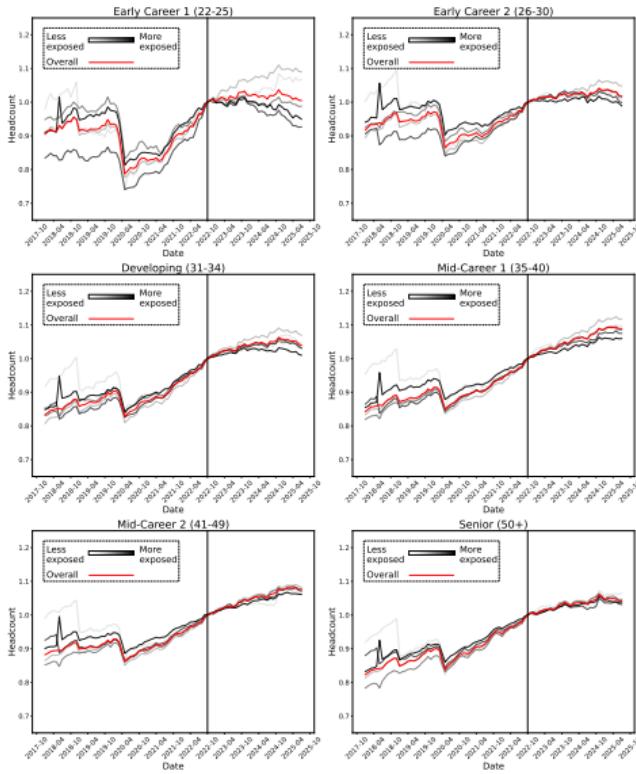
Longer horizon - Claude

▶ Back



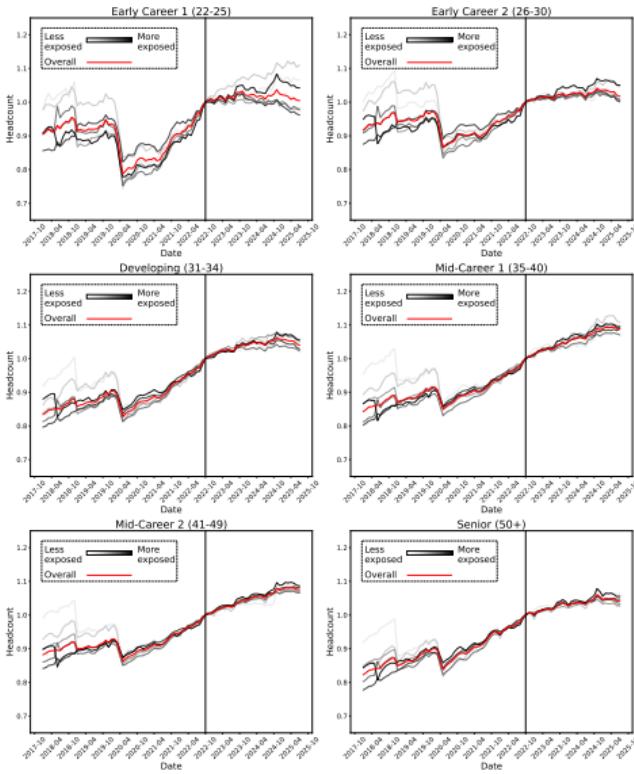
Longer horizon - Automation

[Back](#)



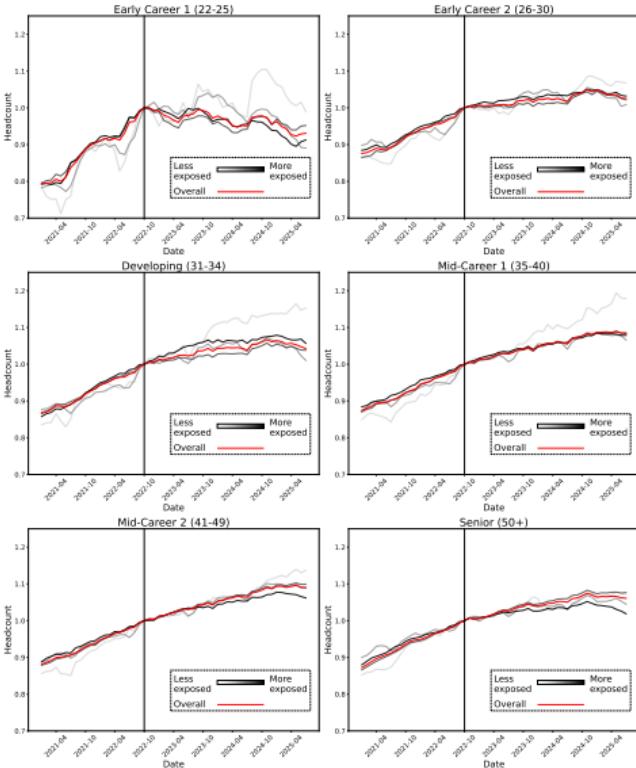
Longer horizon - Augmentation

▶ Back



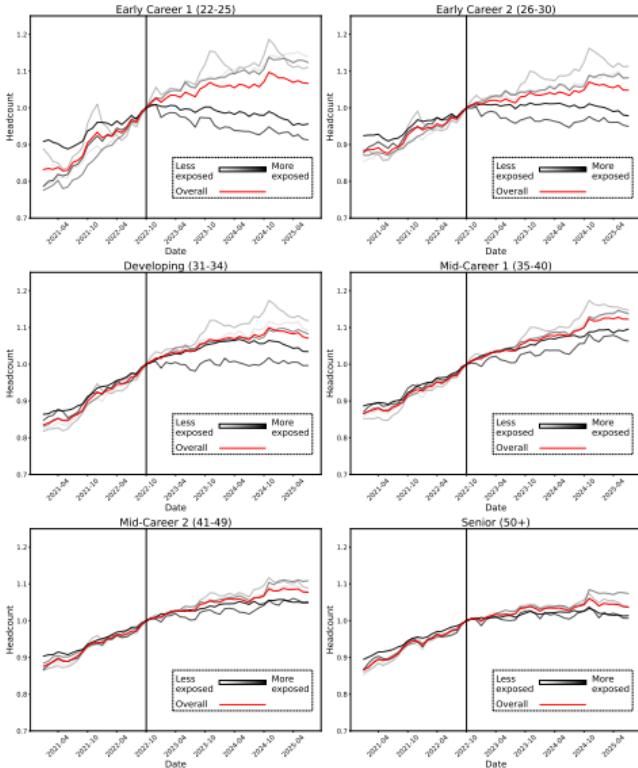
Greater than 70% college educated

▶ Back



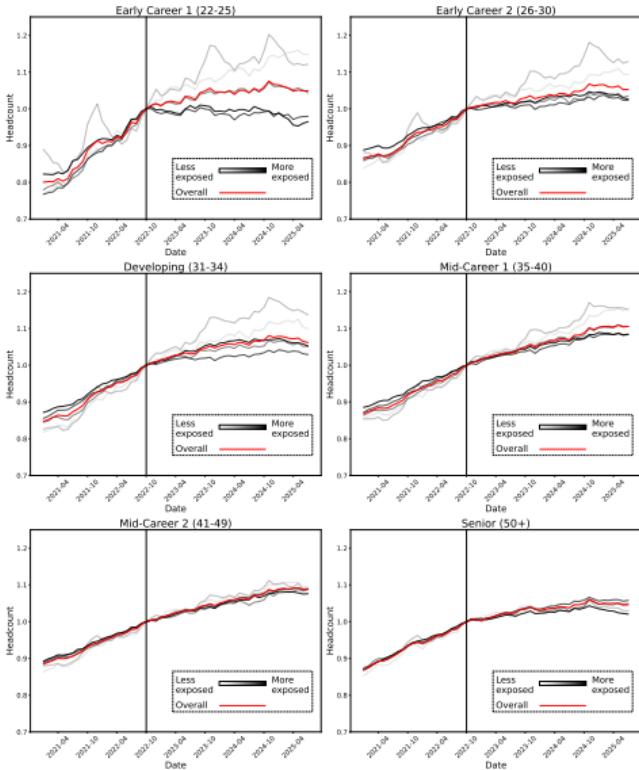
Less than 30% college educated

Back



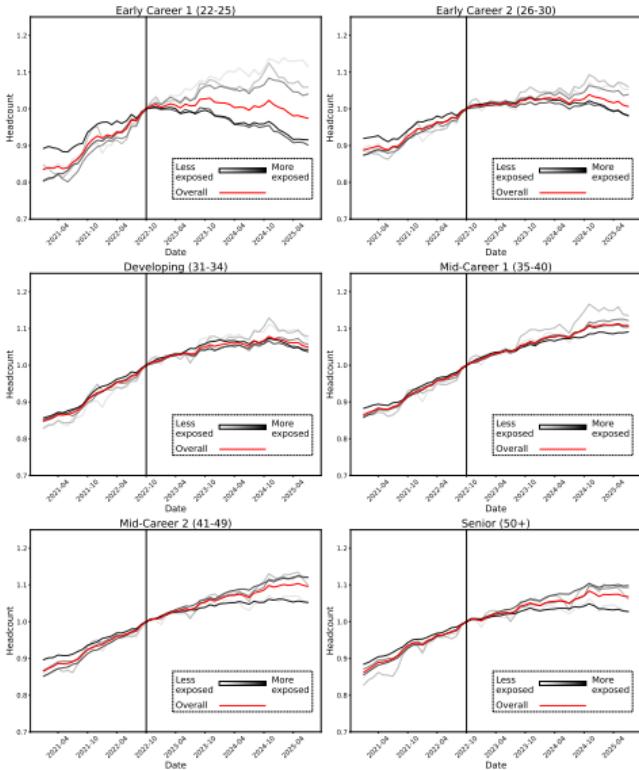
Men

Back



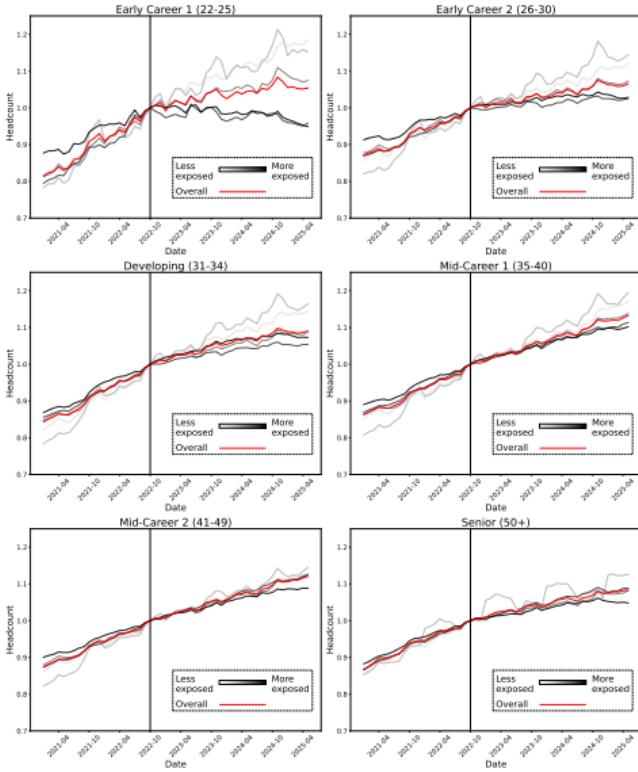
Women

Back



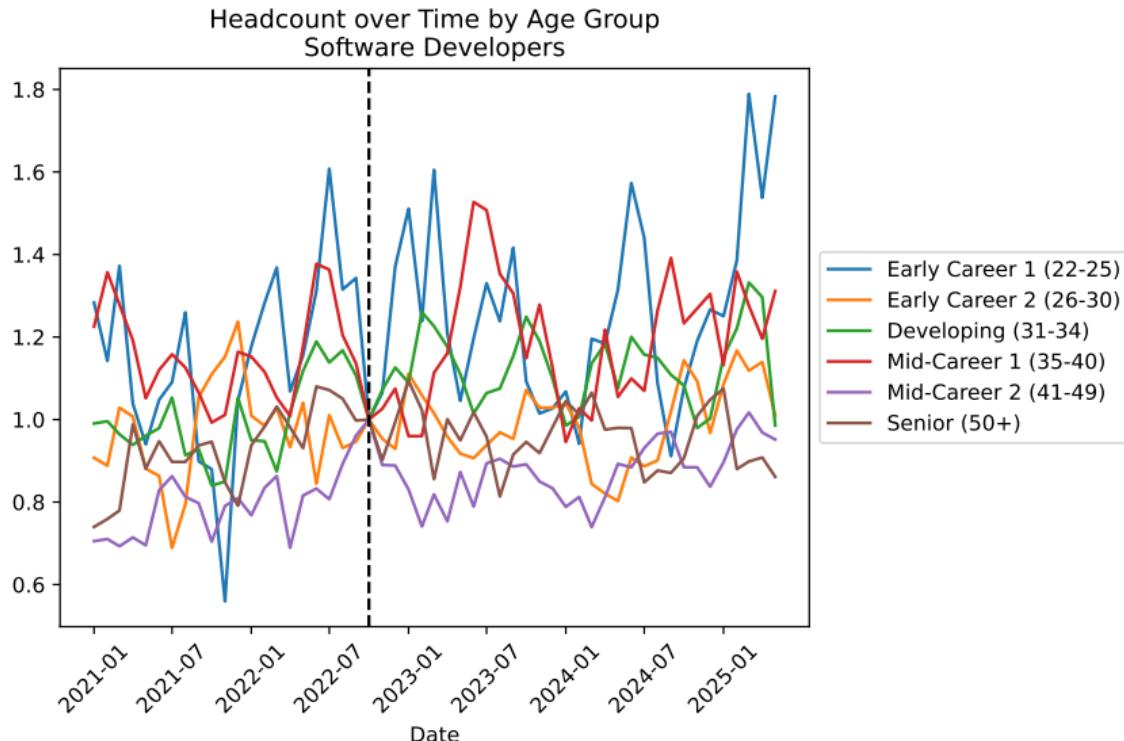
Including part-time and temporary workers

▶ Back



Software developers in the CPS

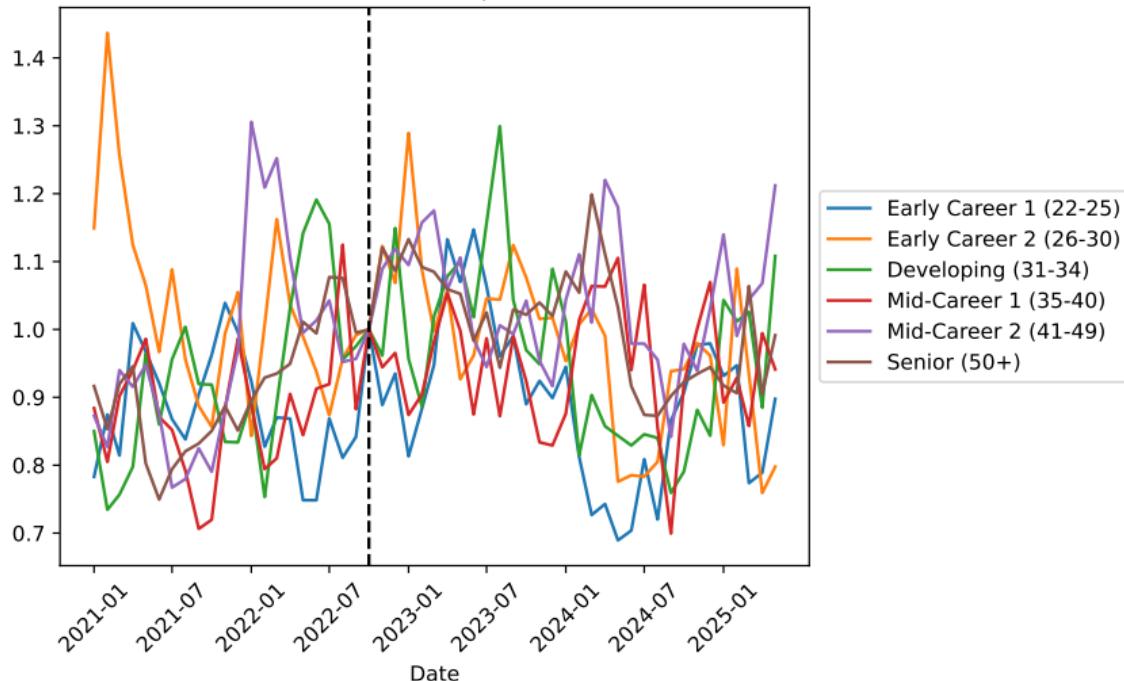
Back



Customer service in the CPS

▶ Back

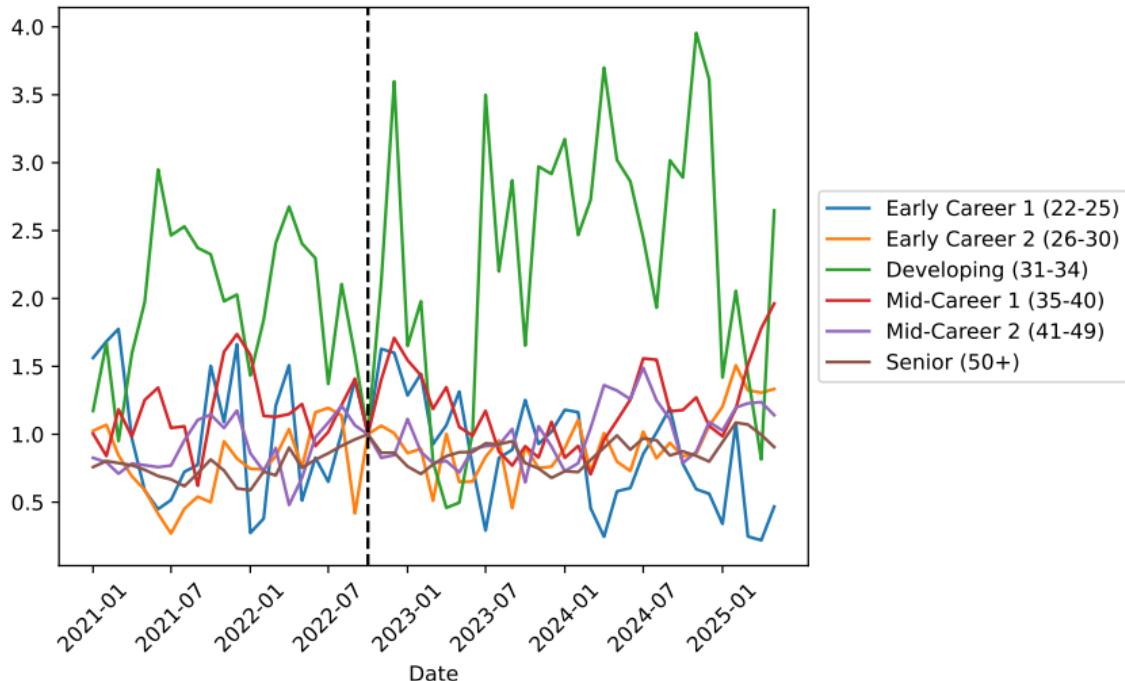
Headcount over Time by Age Group
Customer Service Representatives



Health aides in the CPS

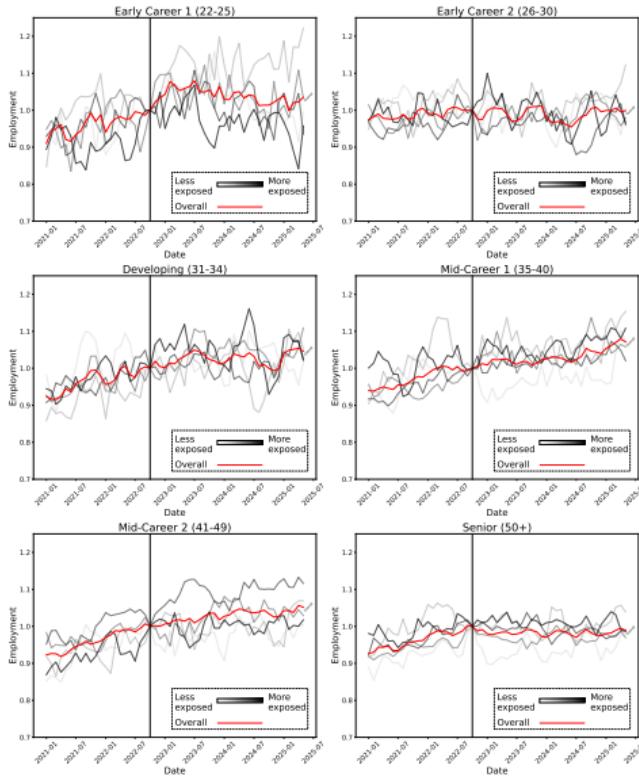
Back

Headcount over Time by Age Group
Home Health Aides



By exposure quintile in the CPS

Back



- CHANDAR, B. (2025): “Tracking Employment in AI-Exposed Jobs,” Tech. rep., Social Science Research Network.
- DOMINSKI, J. AND Y. S. LEE (2025): “Advancing AI Capabilities and Evolving Labor Outcomes,” Tech. rep., arXiv, arXiv:2507.08244 [econ].
- DOSHAY, H. AND A. BANTOCK (2025): “The SignalFire State of Tech Talent Report - 2025,” .
- ECKHARDT, S. AND N. GOLDSCHLAG (2025): “AI and Jobs: The Final Word (Until the Next One),” *Economic Innovation Group*.
- ELOUNDOU, T., S. MANNING, P. MISHKIN, AND D. ROCK (2024): “GPTs are GPTs: Labor market impact potential of LLMs,” *Science*, 384, 1306–1308, publisher: American Association for the Advancement of Science.
- GIMBEL, M., M. KINDER, J. KENDALL, AND M. LEE (2025): “Evaluating the Impact of AI on the Labor Market: Current State of Affairs | The Budget Lab at Yale,” .
- HAMPOLE, M., D. PAPANIKOLAOU, L. D. SCHMIDT, AND B. SEEGMILLER (2025): “Artificial Intelligence and the Labor Market,” Working Paper, National Bureau of Economic Research.
- HANDA, K., A. TAMKIN, M. MCCAIN, S. HUANG, E. DURMUS, S. HECK, J. MUELLER, J. HONG, S. RITCHIE, T. BELONAX, K. K. TROY, D. AMODEI,

J. KAPLAN, J. CLARK, AND D. GANGULI (2025): “Which Economic Tasks are Performed with AI? Evidence from Millions of Claude Conversations,” Tech. rep., arXiv, arXiv:2503.04761 [cs].

HOSSEINI, S. M. AND G. LICHTINGER (2025): “Generative AI as Seniority-Biased Technological Change: Evidence from U.S. Résumé and Job Posting Data,” .

HUMLUM, A. AND E. VESTERGAARD (2025): “Large Language Models, Small Labor Market Effects,” Working Paper, National Bureau of Economic Research.

JOHNSTON, A. AND C. MAKRIDIS (2025): “The Labor Market Effects of Generative AI: A Difference-in-Differences Analysis of AI Exposure,” SSRN Scholarly Paper, Social Science Research Network, Rochester, NY.

KLEIN TEESELINK, B. (2025): “Generative AI and Labor Market Outcomes: Evidence from the United Kingdom,” .

LIM, S., D. STRAUSS, J. BURN-MURDOCH, AND C. MURRAY (2025): “Is AI killing graduate jobs?” *Financial Times*.

PATWARDHAN, T., R. DIAS, E. PROEHL, G. KIM, M. WANG, O. WATKINS, S. P. FISHMAN, M. ALJUBEH, P. THACKER, L. FAUCONNET, N. S. KIM, P. CHAO, S. MISERENDINO, G. CHABOT, D. LI, M. SHARMAN, A. BARR, A. GLAESE, AND J. TWOREK (2025): “GDPval: Evaluating AI Model Performance on Real-World Economically Valuable Tasks,” ArXiv:2510.04374 [cs].

ROCKALL, E., M. MENDES TAVARES, AND C. PIZZINELLI (2025): “AI Adoption and Inequality,” .

TOMLINSON, K., S. JAFFE, W. WANG, S. COUNTS, AND S. SURI (2025): “Working with AI: Measuring the Occupational Implications of Generative AI,” Tech. rep., arXiv, arXiv:2507.07935 [cs].

WILES, E. AND J. J. HORTON (2025): “Generative AI and Labor Market Matching Efficiency,” .